



Effects of Deforestation on Rural Household Income In Vandeikya Local Government Area of Benue State, Nigeria

***Abah, D., *Hembafan V. D and **Esheya, S. E**

**Department of Agricultural Economics, Federal University of Agriculture, Makurdi, P.M.B. 2373, Makurdi, Nigeria. dangod23@yahoo.com*

***Department of Agricultural Economics and Extension National Open University of Nigeria, Kaduna Campus*

Abstract

The study examined the effects of deforestation on rural household income in Vandeikya Local Government Area, Benue State, Nigeria. Data for the study were collected from 134 households using a multi-stage sampling procedure. The data were analyzed using descriptive statistics and multiple regression analysis. Major findings from the study reveal that 66.91% of the respondents were within the active and productive age of 20-50 years, 58.1% were females 65.3% were married, having household size of 11-15 persons. Up to 87.1% of the respondents had one form of education or the other, 85.5% earned N10,000 – 200,000 as their annual household income and 70% have been farming for over 10years. The study also indicated the effects of deforestation on rural households these include Erosion, environmental degradation biodiversity loss, global warming, poverty, change in temperature and rainfall and disruption of water cycle. Results further revealed factors that have significant effect on the income of rural households to include livestock ranching and household size at 10% level of significance, sex, and level of education at 1% level of significance. The F-statistics value of 5.698 is significant at 1% which indicates overall fitness and significance of the regression model used. The estimated R-square has the value of 40.2% showing that 40.2% of the variation in the dependent variable is because of changes in the independent variables. The study therefore recommends that government, community leaders, and policy makers should put their hands on deck in enacting policies for both rural and non-rural based people that restricts forest depletion but promotes reforestation and conservation of forest.

Keywords: *Deforestation, Global warming, Rural household, Biodiversity loss*

Introduction

Deforestation is one of the indiscriminate anthropogenic activities contributing to erosion, flooding, loss of soil nutrients, poor agricultural produce, global warming, climate variability, climate change and desertification (Audu, 2013; Mfon *et al.*, 2014). Deforestation has global consequences, primarily because of the influence on carbon exchange (Alamu and Agbeja, 2011) and it accounts for 87 percent of total carbon emission in Nigeria. With more CO₂ in the atmosphere, more of the sun's radiation is reflected to earth, instead of space, and this causes average temperature to rise (Mfrekemfon and Konwea, 2014). In this way, deforestation is a major issue when it comes to global warming (Ogbuene, 2010). Health problems associated with global warming include heat stroke, climate stress on agriculture predisposing to malnutrition, increase in the number of malaria-carrying mosquitoes putting 65% of the world population on the risk of malaria infection. These increase morbidity and mortality rate (Mfrekemfon and Konwea, 2014).

Many developing countries, like Nigeria, are suffering from serious environmental degradation primarily because of the rapid growth in population which has not only brought about gross encroachment and damage to natural forest, wildlife, land, water and even air but has also brought unacceptable quality of life conditions in the human community environment (Oduntan *et al.*, 2013). The forest reserve in Nigeria is estimated to cover about

10 million hectares, which accounts for more than 10% of land area approximately 96.2 million of ha (Ikuomola *et al.*, 2016). However, Nigeria has the worst deforestation rate in the world which is attributed to her increasing population with high poverty level. The annual rate of deforestation in Nigeria is 3.5% which is approximately 350,000-400,000 hectares per year (Mfirekemfon and Konwea, 2014); resulting in more than 50% loss of primary forests in the past decades through unsustainable logging, agriculture, as well as fuel wood collection (Mfon *et al.*, 2014).

Some policy measures were put in place by government such as ban on logging (1975), Annual Afforestation (1988), National Forest Action Plan (NFAP) (2005), educating farmers about dangers of environmental degradation, providing farmers with high yielding varieties of crop and irrigation equipment. In spite of these policy measures, deforestation continued to increase at alarming rate (Ibrahim *et al.*, 2015). The Federal Ministry of Environment, (2006) also reported that the first ever National Forestry Act has been evolved to back the policy and have since been presented to the Council for ratification and to be passed into law (Ojekunle, 2014). Nevertheless, in recent times the area marked as forest lands have been decreasing steadily due to the indiscriminate felling of trees and activities of illegal loggers which have continued in virtually every part of the country (Alamu and Agbeja, 2011; Ikuomola *et al.*, 2016).

This research has focused on deforestation in one of the rural areas because over 60% of Nigerian population lives in rural communities and depend largely on agriculture, cottage industries and other forms of informal and small-scale natural resources exploitation activities, for rural household income. These activities are often unsustainably carried out, given the paramount motivation to increase household income (Mfon *et al.*, 2014). Nigeria has a population of over 170 million people with an average population growth rate of 2.5%, while a large percentage (70.8%) are living in abject penury, below \$1 per day with 0.826 metric tons carbon dioxide emissions per capital per year. With this population growth and without the concomitance of economic growth or technological advancement the high rate of deforestation is unavoidable (Mohammed, 2014).

Nigerians have always depended on the forest for their survival, economic development, as well as environmental amelioration. However, only half-hearted efforts have been made to control deforestation, leading to the almost destruction of Nigerian forests. Therefore, sustainable development is yet to be achieved (Mfon *et al.*, 2014). The main cause of deforestation in tropical forests is clearing for agriculture to feed the growing population or (to a lesser degree) to earn foreign exchange from export (Oduntan *et al.*, 2013). Also, the economy of fuel wood market is booming as a household preferential choice of energy because of its qualities: availability, accessibility, affordability, source reliability, flexibility, and taste (Mohammed, 2014); without realizing that a substantial amount of carbon stored in the vegetation in the dry zones averaging about 30 tons per hectare, declines when the vegetation is depleted. Carbon rich soils are found in dry zones hence the destruction of these trees has a very powerful effect on the carbon cycle and boosts the greenhouse effect as a result of the depletion of carbon (Alamu and Agbeja, 2011). The use of fuel wood is currently gaining more popularity among the medium and high income earners in urban centres such as Makurdi, Kaduna, Kano, Lokoja, Ibadan, Sokoto, Ilorin, Jalingo and Minna among others due to the scarcity and cost of kerosene as well as local gas (Audu, 2013).

A consequence of the rapid increase in human populations, settlements, and encroachments globally is the concomitant rapid decline in biological diversity, with significant shifts in species community composition and severe disruption to established food webs, which are directly tractable to land-use change and deforestation (Aaron *et al.*, 2016). Deforestation is a

major problem occurring in many parts of Nigeria and the most serious affected region is the less endowed northern part of the country with the forests and game reserves being intensively and extensively exploited.

As a global challenge, tropical deforestation has gained greater impetus in policy and research. Mahapatra and Kant (2003) stated that since the early 1980s, policy makers have responded to tropical deforestation with various bilateral and multilateral initiatives such as Tropical Forestry Action Plan, International Tropical Timber Organization and Forest Principles. They also indicated that there is increasing research on various dimensions of tropical deforestation by many scientists, such as Mfon, *et al.* (2014) on challenges of deforestation in Nigeria and the Millennium Development Goals, Ogbuene, (2010) on environmental consequences of rainfall variability and deforestation in Southeastern Nigeria, Aliyu *et al.* (2014) on Impacts of deforestation on socioeconomic development of Akwanga and Nasarawa state, and Ojekunle (2014) on the effects and linkages of deforestation and temperature on climate change in Nigeria. In spite of the various research conducted on deforestation, little or no research has been carried out on The Effects of Deforestation on Rural Household Income in Benue state, Nigeria.

Methodology

The study was conducted in Vandeikya Local Government Area in Benue state, Nigeria. Vandeikya Local Government is located between latitude 7° 5' north of the equator and longitude 9° and 9° 6' east of Greenwich. It has a landmass of 183,939 square meters (0.7sq.mile) with a population of well over 234,567 (NBS, 2006). Vandeikya is in the southeastern part of Benue state and share boundaries with Obudu and Bekwara in cross river state to the east, Ushongo to the north and Konshisha L.G.A. to the west. There are twelve administrative council wards. Vandeikya Local Government Area was carved out of Gboko Local Government council in 1976. The indigenous community is the Tiv people who speak Tiv language. Vandeikya Local Government Area is dominated by undulating terrain with much of the area being below 183m (600ft) above the sea level. Surface drainage is generally good with almost all the rivers being seasonal, notably River Aya and River Be. Agriculture is the mainstay of the people with available land for the sheep, goats and cattle rearing. Over 80% of the population are directly engaged in peasant farming of virtually all major food crops, with concentration on rice, sweet potatoes, cassava, sorghum, citrus, spices, pepper, groundnut and bambara nut. The Local Government is enhanced with manual deposits such as Barate, Kaolite and Iron ores. The settlement pattern is dispersed with thatched round houses.

The population of the study comprised of all rural households in Vandeikya Local Government area. A multistage sampling technique was used for the study. The sampling frames developed for each village using a proportional allocation of 10% across board is shown in Table 1. Primary data was used for this study. This was collected with the aid of structured questionnaire administered to the selected households. The objectives of this study were analyzed using descriptive and inferential statistics such as such as frequency, percentage, table, mean and multiple regression.

The study specified a multiple regression model to determine the effects of deforestation on rural income, represented as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7) + U$$

Where

- Y = Household Income
- X₁ = Agricultural Expansion
- X₂ = Bush Burning
- X₃ = Livestock Ranching

- X_4 = Infrastructural Expansion
 X_5 = Fuel wood Harvesting
 X_6 = Unregulated Logging
 X_7 = Over Population
 U = Error Term

Table 1: Sample size selection plan

S/No.	Districts	Villages	Sampling Frame	Sampling Size
1.	Mbakaange	Aginde	100	10
		Dyegh	120	12
2.	Mbagbera	Achwa	70	7
		Naa	120	12
3.	Mbayongo	Adamgbe	150	15
		Ukpe	100	10
4.	Tsambe	Adeiyongo	100	10
		Gbem	170	17
5.	Ute	Agu	100	10
		Kotiyough	120	12
6.	Ningev	Bako	170	17
		Agirgba	100	10
Total				132

Source: Adopted from FADAMA III Development Project, (2013)

Results and Discussion

Socio-Economic Characteristics of the Respondents

The result of the socioeconomic characteristics of the respondents is presented in Table 2. The result reveals that 39.5% of the respondents fall between 20-40 years, 27.41% fall between 41-50 years, 15.3% fall between 51-60 years and 17.1% fall between 61-80 years with mean age of 45.50. Since youth have the highest percentage, it implies that the rural households interested in forest resource activities are mostly youth and are therefore in their active and productive age. This result agrees with Nzeh and Eboh (2008) who reported that youth appear uninterrupted in forest resource activities. The results further shows that majority (58.1%) of the respondents were female while 41.9% were male. This implies that female are more involved in forest activities and hence contribute more to deforestation in the study area, this could be because women have greater needs for forest products and also have greater access to forest than men. This supports the findings of Raufu *et al.* (2012) who stated that women have greater access to forest than men. The result also shows that 11.3% of the respondents were single, 65.3% were married and 23.4% were widowed. Given the fact that majority of the respondents are married, it is appropriate to infer that their stay in the communities and their livelihood sustainability depend largely on the forest and its resources relative to those that are singles or divorce that are quite mobile and can therefore migrate to other parts of the country in search for greener pastures.

The result also shows that most (51.6%) of the respondents had household size of 11-15 persons, 22.6% had 16-20 persons, 21.8% had 1-5 persons and 1.6% had 21-25 persons with mean of 8.7.

Table 2: Socio-Economic Characteristics of Respondents

Variable	Frequency	Percentage (%)
<u>Age</u>		
20-30	20	16.1
31-40	29	23.4
41-50	34	27.41
51-60	19	15.3
61-80	22	17.1
Total	124	100
<u>Gender</u>		
Male	52	41.9
Female	72	58.1
Total	124	100
<u>Marital status</u>		
Single	14	11.3
Married	81	65.3
Widowed	29	23.4
Total	124	100
<u>Household size</u>		
1-5	27	21.8
11-15	64	51.6
16-20	28	22.6
21-25	2	1.6
26-30	3	2.4
Total	124	100
<u>Education</u>		
No Education	16	12.9
Primary	21	16.9
Secondary	56	45.2
Tertiary	31	25
Total	124	100
<u>Farming Experience</u>		
1-6	8	6.5
7-12	29	23.4
13-18	22	17.7
19-24	22	17.7
25-30	15	12.1
31-50	22	17.7
>50	6	4.8
Total	124	100
<u>Annual income</u>		
10000-200000	106	85.5
200001-400000	15	12.1
400001-600000	3	2.4
Total	124	100
<u>Extension Visit</u>		
No Extension Visit	52	41.9
Extension Visit	72	58.1
Total	124	100
<u>Number of Extension visits</u>		
0-5	66	53.2
6-10	4	3.2
11-15	1	0.8
Total	124	100

Source: Field survey (2019)

This indicates a high percentage household size in the study area thus implying that large families are normally associated with a high labour endowment, which enables them carry out their farming activities. This agrees with Musa (2009) who reported that the implication of a large family size is in the fact that farmers have more hands to be employed for labour

because of the number of working persons in the family. More so, 45.2% of the respondents had secondary education, 25% had tertiary education, 16.9% had primary education and the remaining 12.9% had no formal education. This implies that majority of the respondents were literates having a form of education or the other. This means that they could manage forest resources efficiently knowing the effects of deforestation. The result shows that about 85.5% of the respondents earned between ₦10000-₦200000 as their annual income, 12% earned between ₦200001-₦400000 as their annual income while 2.4% earned between ₦400001-₦600000 as their annual income with mean of ₦118820. This implies that the respondents are low-income earners. This low income could be due to loss of forest products resulting from deforestation.

Results further showed the farming experience of the respondents 17.7% had farming experience of 13-18years, 19-24 years and 31-50 years while 6.5% indicated 1-6 years, 23.4% indicated 7-12 years, 12.1% indicated 25-30 years and 4.8% indicated that they have been farming for over 50 years with a mean of 22.2years. Accordingly, over 70% of the respondents have been farming for over a decade and are well acquainted with issues of crop production and trends of productivity over the years. Undoubtedly, this knowledge puts the respondents in a better position to know the effects of deforestation on crop production and consequently evoke appropriate adaptation strategies that support their subsistence.

Causes of Deforestation

The result of the causes of deforestation in the study area is presented in Table 3. The result reveals that 100% of the respondents indicated bush burning and fuel wood harvesting as the major causes of deforestation. This implies that bush burning, and fuel wood harvesting are severe causes of deforestation in the study area and have been witnessed by all the respondents. This agrees with Mfon *et al.* (2014) who reported that continues burning of the rainforest leads to grasslands as most of the trees including their seedlings are destroyed. The result however disagrees with Cooke, Kohlin and Hyde (2008) who argued that even in areas where forests were cleared there was no shortage of firewood. Also, 98.4% of the respondents indicated overpopulation as a cause of deforestation; this could be due to increasing development of residential and public areas. This agrees with the findings of Mfon *et al.* (2014) which observed that increase in population and demographic pressure contributes immensely to deforestation problem in Nigeria.

The result further reveals also that 92.7% of the respondents indicated unregulated logging as a cause of deforestation. This implies that logging in the study area was primarily unregulated and used for different purposes which could include household furniture. The result agrees with the reports of Transparency International (2011) which reported that lack of integrity in the judiciary to check illegal logging further promotes deforestation. Furthermore, 69.4% of the respondents indicated infrastructural expansion as a cause of deforestation. This implies that siting of industries, dams, mining activities, feeder roads network and other infrastructural activities are severe causes of deforestation and has been witnessed by more than half of the entire respondents. This conforms to the findings of Tuma (2007) who reported that the distribution of the land use has been changing greatly overtime because of subsequent cultivation after deforestation and due to high population and economic pressure, and infrastructure development. More so, 97.6% of the respondents indicated agricultural expansion as a cause of deforestation. The implication of this is that most of the respondents agreed to large scale agricultural activities being a major factor causing deforestation in the study area. The result agrees with the findings of Ogunwale (2015) who posited that large-scale agriculture which requires a large land capital has also consumed a large portion of forested areas in Nigeria.

Table 3: Causes of Deforestation

Variable	Frequency	Percentage	Rank
Bush burning	124	100	1 st
Fuel wood harvesting	124	100	1 st
Overpopulation	122	98.4	3 rd
Agricultural expansion	121	97.6	4 th
Unregulated logging	115	92.7	5 th
Infrastructural expansion	86	69.4	6 th
Livestock ranching	61	49.2	7 th

Source: Field survey (2019)

Economic Benefits of Deforestation on Livelihoods of Rural Households

The result of the economic benefits of deforestation on livelihoods of rural households is presented in Table 4. All respondents in the study area enthused that firewood and charcoal are economic benefit of deforestation on livelihoods of rural households. This implies that forests cleared to provide fuel wood and charcoal enhances livelihoods in the study area, this comes from the sale of these livelihood assets to improve their income. The result also reveals that 99.2% of the respondents indicated land for agriculture as an economic benefit of deforestation on livelihoods of rural households in Vandeikya Local Government. This implies that by clearing out a section of the forest, people have sufficient land space for agricultural purposes, allowing for growing of crops. Hence food output will be increased. The result also shows that 70.2% of respondents are in agreement with the provision of employment opportunities from deforestation activities. It implies that as deforestation increased in the study area, it increased demand for the labour of youth in cutting down trees for lumber and manufacturing industries and transportation of wood, thus an increase in employment opportunities. The result further reveals that 99.2% of the respondents indicated lumber and paper products provision as a benefit of deforestation. This shows that respondents agreed to this benefit of deforestation because an individual cannot carry out basic daily duties without the use of wood and everyone's home contains some type of wood fixture whether it is a wooden table or a piece of paper. The result also shows that 71.8% of the respondents indicated residential land as an economic benefit of deforestation on livelihoods of rural households while 70.2% of the respondents agreed that employment is an economic benefit of deforestation on livelihoods of rural households.

Table 4: Economic Benefits of Deforestation on Livelihoods of Rural Households

Variable	Frequency	Percentage	Rank
Fuel wood and charcoal	124	100	1 st
Land for Agriculture	123	99.2	2 nd
Lumber and paper products	123	99.2	2 nd
Residential land	89	71.8	3 rd
Employment	87	70.2	4 th

Source: Field survey (2019)

Effects of Deforestation on Rural Households

The result of the effects of deforestation on rural households is presented in Table 5, which reveals that 96.8% of the respondents indicated loss of species and biodiversity as effects of tropical deforestation on rural households in Vandeikya local Government area. This implies that deforestation activities in the study area have reduced the wild species of both plants and animals, some of which are of great economic importance, these in turn affects the local community and reduce the quality of life. The result conforms to the findings of Magala (2015) who found that biological diversity and animal species are threatened due to loss of

wildlife habitats and degradation of water-shed areas, hence leading to deterioration of the quality of life and reduction of options for development. The result further reveals that 77.4% of the respondents indicated increase temperature and decrease rainfall. This implies that deforestation negatively affect the climate in the study area and consequently affects agriculture, crop harvest, which tells greatly on the income of farmers. This agrees with the findings of Spracklen *et al.* (2009) who found that deforestation can reduce evapotranspiration due to a loss of vegetation which results in reduced moisture circulation and decreased rainfall. Effects of deforestation on rainfall which indirectly impacts agriculture agrees with Lobell *et al.* (2011) who reported that changes to rainfall and surface temperatures are expected to impact agriculture and crop harvest, with an approximate 10% reduction in crop yields for a 1% rise in temperature.

Deforestation is found to have caused erosion severely in the study area based on the results which showed that 97.6% of the respondents indicated erosion as an effect of deforestation. This shows that in the absence of forest, there is limited interception of rainfall, and the rain hits directly on the soil, this washes away the topsoil. In line with this, Bradshaw *et al.*, (2017) reported that loss of forests can lead to increased run off as there is limited interception of rainfall and reduced evaporation of water from the canopy. Results also reveal that 97.6% of the respondents indicated that environmental degradation is an effect of deforestation on rural households. This implies that there is a very strong relationship between deforestation and environmental degradation on rural households because erosion and decline of the quality of the natural environment which is due to environmental degradation is a global problem. The result further reveals that 71% of the respondents indicated disruption of water (hydrologic) cycle. This shows that deforestation leads to disruption of water cycle, this is because forests are a vital constituent of the global water cycle, as they have a high evaporation rate, contributing to atmospheric moisture circulation. This agrees with the findings of Greenpeace (2013) which noted that deforestation weakens the local hydrologic cycle, and a new pattern of heat release occurs due to the changed land cover.

Also, 92.7% of the respondents pointed out global warming as a consequent of deforestation in the study area. This implies that there is a relationship between deforestation and global warming because forests, notably tropical forests are major carbon sinks. The loss of tropical forests means the collapse of major carbon sinks and generation of more carbon dioxide which is a serious threat to global climate and atmospheric temperature distribution. This agrees with the arguments of The Economics of Ecosystems and Biodiversity (TEEB), (2010); Owusu *et al.*, (2011) and Insaadoo *et al.* (2012) who noted that deforestation and forest degradation in developing countries are held to account for about 18% -20% of increased emission of greenhouse gases that are responsible for global warming and climate change. The result further shows also that 78.2% of the respondents indicated rural poverty as an effect of deforestation on rural households. This reflects the close relationship between deforestation and poverty of rural households because increased deforestation leads to loss of livelihood assets and outcomes (loss incomes, employment, food, medicine) and since the survival of most rural households is dependent on these livelihoods, it is likely to aggravate poverty which is often endemic in rural areas.

Table 5: Effects of Deforestation on Rural Households

Variable	Frequency	Percentage	Rank
Erosion	121	97.6	1 st
Environmental degradation	121	97.6	1 st
Loss of species and biodiversity	120	96.8	3 rd
Global warming	115	92.7	4 th
Rural poverty	97	78.2	5 th
Increase temperature and decrease rainfall	96	77.4	6 th
Disrupt water cycle	88	71.0	7 th

Source: Field survey (2019)

Strategies for Reducing Deforestation

The result in Table 6 reveals that 96% of the respondents indicated use of alternative forms of cooking fuel as strategies for reducing deforestation. These could include Natural gas, kerosene and electrical power for cooking which will help in reducing deforestation. The implication of this is that almost all the respondents in the study area aggravated the scale of demand for firewood, and charcoal due to their dependence on forest wood rather than the use of other alternative energy sources of cooking. This result agrees with Mohammed (2014) who noted that in order to enhance the energy security of the country and establish a sustainable energy supply system, it is necessary to promote the policy of diversifying the energy supply so as to include alternative renewable sources and technologies into the nation's energy supply mix. The result also reveals that 61.3% of the respondents indicated reduction in paper use as a means of combating deforestation. This implies that collection of lumber and paper products for production of paper from forests leads to deforestation to some extent. Thus, a reduction in paper consumption will help to reduce deforestation. This disagrees with Warren (2017) who reported that paper use does not create a net reduction in forest cover, all wood used to produce paper is sourced from managed timberlands, also known as tree farms, which are grown specifically for this purpose. The result shows that 91.1% of the respondents indicated forests can be sustainably protected through strict regulations. This could reduce illegal forest activities and promote forest conservation. This is similar to the idea that the balance of rights can be tilted towards society in the form of publicly owned strictly protected areas. As of now, much of the world's tropical forest are state owned but community participation in forest ownership and management needs to be encouraged with restrictions on extraction and conversion (Chomitz *et al.*, 2007).

Furthermore, all the respondents agreed to reforestation as an effective means of reducing deforestation. According to the findings, respondents have some knowledge of reforestation programs which were not fully implemented and supervised. Respondents expressed a belief in this strategy if it will be fully enacted. This agrees with Warren (2017) who posited that another solution to deforestation is to plant more trees to replace those already lost. The result again reveals that 95.2% of the respondents were for Eco-forestry practice. This implies that only selected trees should be cut and should be handled properly to avoid damage to the area. This agrees with Ronca (2008) that only carefully selected trees are cut down and are transported with minimal damage to the area; the forest ecosystem is preserved while commercial timber extraction is still permitted. The result reveals that 59.7% indicated reduction in meat consumption. This implies that demand for meat keeps constantly rising but the space to rear livestock does not, hence animal farming has become a factor of deforestation. According to the views of the respondents, reduction in meat consumption will to some extent help to combat deforestation. This agrees with the findings of Slavikova (2018) who reported that the choice to reduce the amount of meat eaten will lower the global

demand for meat and help prevent further destruction of forests to make way for more livestock.

Table 6: Strategies for reducing Deforestation

Variable	Frequency	Percentage	Rank
Reforestation	121	100	1 st
Alternative forms of cooking fuel	119	96.0	2 nd
Eco-forestry	118	95.2	3 rd
Protection of forest through strict regulation	113	91.1	4 th
Advertising campaigns	106	85.5	5 th
Using less paper	76	61.3	6 th
Reduction in meat consumption	74	59.7	7 th

Source: Field survey (2019)

Effects of Deforestation on Rural Households Income

The result of the effect of deforestation on rural household income is presented in table 7. The result reveals that livestock ranching is negatively significant (-1.776) at 10%, this implies that increase in expenditure on livestock ranching reduce farmers income. Sex is positively significant (2.660) at 1%. This implies that if there is an increase in the number of women as household head, then there will be increase in income accruing from forest, this is because women have greater access to forest than men. This is in line with the findings of Raufu *et al.* (2012) who reported that women have greater access to forest than men. Household size is found to be positively significant (1.836) at 10%. This implies that larger household brings about increased output from farm which culminates into higher income of households. This is because large families are normally associated with high labour endowment, which enables them carry out their farming activities. This agrees with Musa (2009) who reported that the implication of the result of a large family size is in the fact that the farmers have more hands to be employed for labour because of the number of working persons in the family. Level of education is also found to have positive significance (3.326) at 1%. This shows that the higher the level of education, the higher the income of the farmers since they will be able to accept and utilize improved methods of farming and improved farm inputs which brings about more output. The F- statistics value of 5.698 is significant at 1%.; this indicates overall fitness and significance of the regression model used. Thus, the null hypothesis (H_0) which states that Deforestation has no effect on the income of rural households is rejected. The estimated R-square has the value of 40.2 which means that 40.2% of the variation in the dependent variable is because of changes in the independent variables. This implies a moderately high degree of relationship between the dependent variable and the independent variables.

Table 7: The Effect of Deforestation on Rural Household Income

Variables	Coefficients	Std. Error	t. test	Significance
Constant	-107668.126	114322.076	-0.942	0.348
Agricultural expansion	-21172.883	53334.358	-0.397	0.692
Livestock ranching	-34245.060	19280.374	-1.776*	0.78
Infrastructural expansion	-12374.060	209331.734	-0.591	0.556
Unregulated logging	-3868.739	31418.443	-0.123	0.902
Overpopulation	16518.867	61275.388	0.270	0.788
Bush burning	73736.741	52721.466	1.399	0.165
Fuel wood harvesting	-20165.072	52894.238	-0.381	0.704
Age	1252.346	1373.510	0.912	0.364
Sex	47306.894	17784.298	2.660***	0.009
Marital status	-14436.640	17050.578	-0.847	0.399
Household size	3613.809	1968.468	1.836*	0.069
Level of education	6625.411	1991.971	3.326***	0.001
Farming experience	1859.723	1287.244	1.445	0.151
(F-statistics 5.698)				
R-square 40.20				

* and *** Significant at 10% and 1% respectively

Source: Field survey, (2019)

Conclusion and Recommendations

Conclusively, the study revealed the drastic negative effects deforestation has on rural households, ranging from climate change, reduction in environmental quality as well as the effects on income. Most rural dwellers depend on farm and off-farm activities to generate income in order to sustain their life. Forest resource is one of the major resources on which most of the community depend on to generate income and household usage. This results in resource overexploitation and ultimately, deforestation with dire consequences on the environment.

The study therefore recommends that:

- There should be a policy on wood harvest from forests, restricting both rural and non-rural based people from illegal logging. Strict regulations by Government and Non-governmental organizations should be enacted to reduce deforestation.
- Advertising campaigns for sensitization of the local community on the unfriendly effects of deforestation should be encouraged.
- Policies and strategies that aim at improving the welfare of rural households and natural resource conservation should give attention to alternative livelihood sources and discourage forest depletion.

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